5/3/02

PATENT APPLICATION

IN THE U.S. PATENT AND TRADEMARK OFFICE

May 3, 2002

#10/B
Amdt
J. McClain
5/7/02

Applicants: Motohide TAKEICHI et al

For: COG-ASSEMBLY AND CONNECTING MATERIAL TO BE USED THEREIN

Serial No.: 09/659 448 Group: 2814

Confirmation No.: 5818

Filed: September 11, 2000 Examiner: Graybill

Atty. Docket No.: Yanagihara Case 52

Assistant Commissioner for Patents
Washington, DC 20231

RESPONSE

Sir:

In response to the Office Action dated December 3, 2001, Applicants respectfully request entry of the following amendments:

"B" Amends
Entered 5-3-02

IN THE ABSTRACT OF THE DISCLOSURE

Please replace the Abstract with the new Abstract of the Disclosure enclosed herewith. A marked-up copy is also enclosed.

IN THE SPECIFICATION

Please replace the Specification with the Substitute Specification enclosed herewith. A marked-up copy is also enclosed.

IN THE CLAIMS

Please cancel Claims 1, 2, 4 and 5.

Please amend Claims 3, 6 and 7 as follows.

3. (Amended) The connecting material as claimed in claim 8, wherein it comprises 2-40%, based on the volume of the adhesive component, of the electro-conductive particles.

B1 6. (Amended) The COG assembly as claimed in claim 9, wherein the connecting material comprises 2-40%, based on the volume of the adhesive component, of the electroconductive particles.

7. (Amended) The COG assembly as claimed in claim 9, wherein the COG assembly is a liquid crystal display.

Please add new Claims 8-19 as follows.

8. (New) A connecting material for bonding and connecting a semiconductor chip with a substrate glass board and forming a COG assembly in which electrodes provided on the semiconductor chip are held in direct connection with corresponding electrodes provided on the substrate glass board, said connecting material having a tensile elongation percentage at 25°C of at least 5%, after being cured, and comprising:

an adhesive component comprising a thermosetting resin and 6-90 wt.% of a microparticulate elastomer having an average particle size of 30-300 nm and

B2 electroconductive particles.

9. (New) A COG assembly comprising a semiconductor chip having electrodes provided thereon and a substrate glass board having electrodes provided thereon corresponding to the electrodes provided on the semiconductor chip, the electrodes provided on the semiconductor chip being held in direct connection with the corresponding electrodes provided on the substrate glass board by a connecting material, the connecting material having a tensile elongation percentage of at least 5% at 25°C, after being cured, and comprising an adhesive

component comprising a thermosetting resin and 6-90 wt.% of a microparticulate elastomer having an average particle size of 30-300 nm and electroconductive particles.

10. (New) The connecting material of Claim 8, wherein the microparticulate elastomer has an average particle size of 50-200 nm.

11. (New) The COG assembly of Claim 9, wherein the microparticulate elastomer has an average particle size of 50-200 nm.

Cont'd B2

12. (New) The connecting material of Claim 8, wherein the electroconductive particles have an average particle size of from 1-20 μm.

13. (New) The COG assembly of Claim 9, wherein the electroconductive particles have an average particle size of from 1-20 μm.

14. (New) The connecting material of Claim 8, wherein the thermosetting resin is an epoxy resin.

15. (New) The COG assembly of Claim 9, wherein the thermosetting resin is an epoxy resin.

16. (New) The connecting material of Claim 8, wherein the microparticulate elastomer is selected from the group consisting of natural rubber, isoprene rubber, butadiene rubber, styrene-butadiene rubber, chloroprene rubber and acrylonitrile-butadiene rubber.

17. (New) The COG assembly of Claim 9, wherein the microparticulate elastomer is selected from the group consisting of natural rubber, isoprene rubber, butadiene

rubber, styrene-butadiene rubber, chloroprene rubber and acrylonitrile-butadiene rubber.

18. (New) The connecting material of Claim 8, wherein the cured connecting material has an elastic modulus of from 0.9-3 GPa at 30°C and a Tg of from 110-160°C.

Cont'd B2

19. (New) The COG assembly of Claim 9, wherein the cured connecting material has an elastic modulus of from 0.9-3 GPa at 30°C and a Tg of from 110-160°C.

REMARKS

Due to the numerous grammatical and idiomatic errors contained in the originally filed abstract and specification, Applicants are enclosing herewith a substitute abstract and specification including clean and marked-up copies. The undersigned hereby certifies, to the best of his knowledge and belief, that the enclosed substitute abstract and specification contain no new matter. Favorable consideration is respectfully solicited.

In order to expedite the prosecution of the present application, Claims 1 and 2 have been canceled and replaced by newly presented Claim 8. Claims 4 and 5 have been canceled and replaced by newly presented Claim 9. Newly presented Claims 10-19 are directed to preferred embodiments of the present invention. No new matter has been added.

Claims 1-7 have been rejected under 35 USC 112, second paragraph, as being indefinite. Specifically speaking, the Examiner has stated that the terms "tensile elongation percentage" and "microparticulate elastomer" are unclear because there are no art recognized definitions of these terms and they are not otherwise explicitly defined in the disclosure. Applicants respectfully traverse this rejection.

As is well known in the art, a tensile test measures the force required to stretch a material until it breaks or

ruptures. As such, it would be readily apparent to one of ordinary skill in the art that the tensile elongation percentage is the percent that the tested sample stretches until the rupture point. On originally filed specification page 18, under the heading "Tensile Test", it is described how the tensile test is performed in the present invention and specification page 11, lines 20 and 21, state that the tensile elongation percentage is determined by the method of JIS K-7161. JIS K-7161 corresponds to ISO 5271 or to ASTM D 638. Therefore, Applicants respectfully submit not only does the specification state how the tensile elongation percentage is determined, it also specifies a specific Japanese standard for determining the "tensile elongation percentage". As such, Applicants respectfully submit that the term "tensile elongation percentage" clearly meets the requirements of 35 USC 112, second paragraph, in light of the present disclosure.

With respect to "microparticulate elastomer", Applicants respectfully submit that the definition of this term is self-explanatory. Moreover, on specification page 8, the third and fourth paragraphs explicitly describe the microparticulate elastomer used in the present invention. The Examiner clearly is in error in stating that the present disclosure does not define this term. Applicants are not aware as to how this term could be more particularly described. Therefore, it is respectfully submitted that the rejection of Claims 1-7 under 35 USC 112, second paragraph, clearly is in error. Favorable consideration is respectfully solicited.

Claims 1-6 have been rejected under 35 USC 102(b) as being anticipated by Tomita. Claim 7 has been rejected under 35 USC 103(a) as being unpatentable over Tomita and further in combination with Yamada. Applicants respectfully traverse these grounds of rejection and urge reconsideration in light of the following comments.

The presently claimed invention is directed to a connecting material for bonding and connecting a semiconductor chip with a substrate glass board and forming a COG assembly in which electrodes provided on the semiconductor chip are held in direct contact with corresponding electrodes provided on the substrate glass board. The connecting material has a tensile elongation percentage at 25°C of at least 5%, after being cured, and is made up of an adhesive component comprising a thermosetting resin and 6-90 wt.% of a microparticulate elastomer having an average particle size of 30-300 nm and electroconductive particles. The present invention also is directed to a COG assembly made up of a semiconductor chip having electrodes provided thereon and a substrate glass board having electrodes provided thereon corresponding to the electrodes provided on the semiconductor chip, with the electrodes provided on the semiconductor chip being held in direct connection with the corresponding electrodes provided on the substrate glass board by the connecting material of the present invention.

As discussed in the instant specification, through the use of the connecting material of the present invention, a superior bonding strength and a reliable electrical connection can be attained and the occurrence of local stress concentration at the bonding interfaces by hardening contraction is avoided due to the large tensile elongation percentage of the cured connecting material. This presents deformation, such as warping, of glass circuit boards, even extremely thin glass circuit boards, and prevents deterioration in the image display when used in an LCD. The incorporation of the microparticulate elastomer and the connecting material of the present invention helps give the connecting material these superior properties. It is respectfully submitted that the prior art cited by the Examiner does not disclose the presently claimed invention.

The Tomita reference discloses a circuit connecting material made up of, as the essential ingredients, a hardener which generates free radicals upon heating, a hydroxylated resin having a molecular weight of 10,000 or higher and a radical-polymerizable substance. Although Tomita does disclose in Claim 6 a phenoxy resin modified by an elastomer as the adhesive component, and further discloses in Claim 10 the incorporation of an acryl rubber, this reference does not disclose the use of an elastomer or rubber in microparticulate form dispersed in an adhesive component. In Tomita, the elastomer or rubber is mixed in a uniform mixture with the other adhesive components by melt-heating. Tomita has no disclosure with respect to any advantages being gained by a microparticulate elastomer being present in the adhesive composition.

In the originally presented specification, there is objective evidence of the unobviousness of the presently claimed invention. In Table 1 on page 21 of the originally filed specification, Comparative Example 2 is different from the present invention in the fact that only 5 wt.% of a microparticulate rubber is used. In Comparative Example 3, 10 wt.% of an acrylic resin, which corresponds to the acryl rubber of Tomita, is used. When the properties of the connective materials of the Comparative Examples are compared with those of the present invention, which are shown in Examples 1-4, it is readily apparent that the connective material of the present invention has unexpectedly superior properties thereover. Nothing in the Tomita reference suggests that a connecting material having the properties of the presently claimed invention would result from the incorporation of the claimed amount of microparticulate rubber therein. As such, it is respectfully submitted that the test data contained in the present specification establishes a showing of unexpectedly superior properties in association

with the presently claimed invention and patentably distinguishes the presently claimed invention over the Tomita reference.

The Yamada reference has been cited by the Examiner as showing the use of a connecting material in a liquid crystal display COG assembly. However, the Yamada et al reference does not cure the deficiencies in the primary reference in that there is no disclosure contained therein which would suggest the incorporation of a microparticulate elastomer in the claimed amount into the conductive thermosetting connective material of Tomita. Therefore, it is respectfully submitted that the presently claimed invention is patentably distinguishable over Tomita in combination with Yamada et al.

Reconsideration of the present application and the passing of it to issue is respectfully solicited.

Respectfully submitted,

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Encl: Marked-Up Substitute Specification and Abstract
Clean Substitute Specification and Abstract
Marked-Up Amended Claims 3, 6 and 7
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3. (Amended) The connecting material as claimed in claim ~~1~~8, wherein it comprises 2-40%, based on the volume of the adhesive component, of the electro-conductive particles.

6. (Amended) The COG assembly as claimed in claim ~~4~~9, wherein the connecting material comprises 2-40%, based on the volume of the adhesive component, of the electroconductive particles.

7. (Amended) The COG assembly as claimed in claim ~~4~~9, wherein the COG assembly is a liquid crystal display.